



INTERGRADATION OF HABITATS OF NON-VOLANT SMALL MAMMALS IN THE PATCHY CERRADO LANDSCAPE ¹

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ABSTRACT: The relevant literature on the community composition, population densities, habitat preference, and interspecific relations of small mammals in the Cerrado biome of central Brazil is surveyed, and their community structure in different habitats of the open savanna as well as in forested habitats, especially gallery forests, is analyzed. Small mammal communities differ along a gradient of natural habitats in the Cerrado landscape. There are habitat generalists occurring in more than three types of habitat (pan-habitat species) and habitat specialists, showing a high degree of fidelity to habitat. Most species are of the latter kind, displaying high habitat specificity. Habitat structure is the major factor determining small mammal communities within the Cerrado landscape. Community differences appear to be a function of local mosaic factors as well as differences among river basins, between high plateau forested habitats and lowland valley forests, or between moister open areas with soft soil and abundant grass versus very dry and rocky microhabitats.

Key words: Cerrado, conservation, habitats, marsupials, rodents, small mammals.

RESUMO: Intergradação de habitats de pequenos mamíferos não-voadores na paisagem retalhada do bioma Cerrado.

Contribuições consistentes para o conhecimento dos pequenos mamíferos do bioma Cerrado do Brasil central são examinadas, especificamente sobre composição de comunidades, densidade de populações e preferência de habitat. A estrutura de comunidade de pequenos mamíferos é analisada em habitats diferentes do Cerrado aberto bem como em habitats florestados das matas de galeria. As comunidades de pequenos mamíferos diferem num gradiente de habitats da paisagem do Cerrado. Há espécies habitat-generalistas que ocorrem em mais de três tipos de habitats (espécies pan-habitativas) e espécies habitat-especialistas, restritas a um tipo de habitat, que compreendem a maioria das formas, indicando alta especificidade. Estrutura de habitat é o fator mais importante para determinar a comunidade de pequenos mamíferos no Cerrado. Essas diferenças parecem ser função das características locais dos mosaicos, como também diferenças entre bacias hidrográficas, ou ainda, diferenças entre habitats florestados localizados nos platôs altos comparados com matas de vales em depressão, ou diferenças detectadas em porções de solos úmidos de Cerrado com abundância de gramíneas, comparados com microhabitats de solos secos e pedregosos.

Palavras-chave: Cerrado, conservação, habitats, marsupiais, pequenos mamíferos, roedores.

INTRODUCTION

The Cerrado biome of central Brazil comprises savanna-like vegetation, ranging from open grassland to closed-canopy forested savanna and even true forest along rivers. It originally covered nearly two million km², and is the second largest Brazilian biome after Amazonia (EITEN, 1972; 1993; RIBEIRO & WALTER, 1998, 2001).

The region is not homogeneous in geology, soils, and vegetation cover, which varies from site to site (FELFILI *et al.*, 1994; FURLEY, 1996). It is very easy to cross markedly different kinds of habitats within a distance of only 100-200 meters, from dense gallery forest, through open wet bog and

mesic grassland, to arboreal savanna. The patterns of habitat intergradation are even more complex in ecotone zones of broad contact between biomes (Cerrado-Amazonia to the north; Cerrado-Caatinga to the northeast; Cerrado-Atlantic Forest to the east, and Cerrado-Pantanal to the west). These contact zones vary from moist to semi-arid regions. The intensive human occupation of the Cerrado biome started in 1960, after the inauguration of Brasília, the Nation's new capital. Cattle ranching and, more recently, soybean plantations are the major land use activities (ALHO & MARTINS, 1995; ALHO, *in press*).

This highly mosaic biome is home to endemic plant species and patchily distributed animals. For

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example, it is common to find small mammal species with a preference for forest habitats or for open habitats within the same study area. In the gallery forest, surrounded by open savanna habitats, forest-dwelling arboreal genera such as *Oecomys*, *Oryzomys*, *Oligoryzomys*, and *Rhipidomys* occur within a few meters of open-habitat dwellers such as *Bolomys* and *Oxymycterus*. The genus *Oligoryzomys* also occur in both open and forested habitats. Despite many significant contributions to our knowledge of Cerrado ecology, small mammal distribution and habitat use over the last two decades, the community dynamics and use of space by species within this mosaic landscape are still incompletely understood.

The objective of this review is to document the distribution of small mammals in different kinds of habitats within the Cerrado landscape, to evaluate the relative contribution of the biome to faunal knowledge, to relate the distribution of these species to the mosaic of habitats, and to highlight conservation challenges.

MATERIAL AND METHODS

The savanna vegetation known as Cerrado *sensu lato* (spelled herein with upper-case initial) comprises a variety of different habitats (EITEN, 1972, 1993; RIBEIRO & WALTER, 1998, 2001). Open savannas are termed "campo", ranging from campo limpo (literally "clean field": grassland without shrubs or trees), through campo sujo ("dirty field", with scattered small shrubs), to campo cerrado (savanna with a scattered cover of gnarled trees); wet campo occurs on permanently moist soils. Open-canopy wooded savanna with a grassy understory is known as cerrado *sensu stricto* (lower-case initial), whereas tall, dense, forested savanna with a closed or semi-closed canopy is cerradão. True forest penetrates deep into the Cerrado landscape in narrow bands along rivers and creeks (gallery forests, riverine forests); semi-deciduous mesophytic forest may also be found on well-drained upland slopes. The floristic composition of cerrado, cerradão, mesophytic forest, and gallery forest differs from that of the wet forests with palm trees, locally known as veredas, that are located in waterlogged valley bottoms within the Cerrado (RATTER, 1986; EITEN, 1972, 1993).

This review of small mammal ecology in the Cerrado is based on information presented in published works and graduate dissertations, most of which have been produced during the last twenty years.

RESULTS AND DISCUSSION

Small mammal species show a high degree of habitat fidelity in their distribution within the Cerrado landscape (ALHO, 1981, 1993; ALHO *et al.*, 1986; OLIVEIRA, 1993; REIS, 1993; TALAMONI, 1996; GASTAL, 1997; LACHER & ALHO, 2001; PALMA, 2002). Habitat is an important factor in community structure: species occurring in forested habitats (gallery forests, riverine forests, mesophytic forests, and cerradão) show considerable habitat differences, as do those occupying open savanna habitats (cerrado, campo, wet campo, campo sujo, campo cerrado). The same pattern is also observed when taxonomic groups such as marsupials, murids or echimyids are analyzed (LACHER & ALHO, 2001; PALMA, 2002). Most field work carried out by researchers in the Cerrado is based on trapping along transects through sampling habitats or in grids of capture stations for capture-mark-release-recapture programs. Generally there are substantial differences in the success rates of trap lines along transects or in grids, depending on the kind of habitats (forested habitats have lower rates) and the season (the dry season peak of seeding grasses results in more individual recruitment of open habitat dwellers). Thus, capture success is not homogeneous within the habitats, ranging from 2% to 8% of total trap-nights, 5% being a good success rate. Additionally, different methods may suggest different population sizes: for instance, pit fall traps differ from Sherman traps, and some species, such as *Cavia aperea*, tend to avoid traps altogether. Intensive capture-recapture routines indicated that small mammals were caught in close proportion to their occurrence in a given sample habitat (ALHO, 1981, 1993; ALHO *et al.*, 1986; OLIVEIRA, 1993; REIS, 1993; TALAMONI, 1996; GASTAL, 1997; LACHER & ALHO, 2001; PALMA, 2002).

The distribution of small mammal species among available habitats, based on transitions of vegetation types, reveals that there are habitat generalists and habitat specialists (Tab.1). Three marsupials (*Monodelphis domestica*, *Monodelphis americana*, and *Didelphis albiventris*) are categorized as habitat generalists since they are usually captured in more than three types of habitats. The common opossum *Didelphis albiventris* is caught in gallery forest, cerrado, campo cerrado, and cerradão, and also is commonly seen alive or killed by cars in Brasília and other cities.

Table 1. Species list of small mammals by habitat according to intensive capture-mark-recapture field work surveying the Cerrado landscape.

SPECIES	HABITATS	SOURCES
RODENTS – HABITAT GENERALISTS		
<i>Bolomys lasiurus</i>	Cerrado (s.s.); campo; wet campo; campo-cerrado	Alho <i>et al.</i> , 1986; Lacher & Alho, 2001; Palma, 2002
<i>Oryzomys subflavus</i>	Ecotones of Cerrado and Atlantic Forest and of Cerrado and Caatinga - cerrado (s.s.); wet campo; campo-cerrado; gallery forest	Langguth & Bonvicino, 2002; Bonvicino, 2003; Alho <i>et al.</i> , 1986; Lacher & Alho, 2001; Palma, 2002.
<i>Oryzomys scotti</i>	Cerrado (s.s.); campo; wet campo; campo-cerrado.	Langguth & Bonvicino, 2002; Bonvicino, 2003.
<i>Oryzomys maracajuensis</i>	Cerrado (s.s.); campo; wet campo; campo-cerrado.	Langguth & Bonvicino, 2002; Bonvicino, 2003.
<i>Oryzomys marinhoi</i>	Cerrado (s.s.); campo; wet campo; campo-cerrado.	Langguth & Bonvicino, 2002; Bonvicino, 2003.
MARSUPIALS – HABITAT GENERALISTS		
<i>Monodelphis domestica</i>	Cerrado (s.s.); campo; campo cerrado; wet campo; gallery forest	Alho <i>et al.</i> , 1986; Lacher & Alho, 2001; Palma, 2002
<i>Didelphis albiventris</i>	Cerrado (s.s.); campo; campo-cerrado; gallery forest; mesophytic forest	Alho <i>et al.</i> , 1986; Lacher & Alho, 2001; Palma, 2002
<i>Monodelphis americana</i>	Cerrado (s.s.); campo; campo-cerrado; gallery forest	Alho <i>et al.</i> , 1986; Lacher & Alho, 2001; Palma, 2002
RODENTS – HABITAT SPECIALISTS		
<i>Akodon lindberghi</i> (listed as <i>Plectomys paludicola</i>)	Gallery forest	Alho <i>et al.</i> , 1986
<i>Akodon cursor</i>	Gallery forest; mesophytic forest; cerradão	Alho <i>et al.</i> , 1986; Mares & Ernest, 1995; Gastal, 1997; Palma, 2002
<i>Akodon montensis</i>	Campo; cerradão; gallery forest.	Oliveira, 1993; Talamoni, 1996
<i>Calomys expulsus</i>	Campo; cerrado (s.s.).	Bonvicino & Almeida, 2000; Bonvicino <i>et al.</i> , 2003; Oliveira, 1993; Palma, 2002.
<i>Calomys tener</i>	Campo; cerrado (s.s.).	Bonvicino & Almeida, 2000; Bonvicino <i>et al.</i> , 2003; Oliveira, 1993; Palma, 2002.
<i>Calomys tocantinsi</i>	Cerrado (s.s.); campo.	Bonvicino & Almeida, 2000; Bonvicino <i>et al.</i> , 2003.
<i>Nectomys squamipes</i>	Gallery forest	Gastal, 1997; Palma, 2002
<i>Oecomys bicolor</i>	Gallery forest; cerradão	Gastal, 1997; Palma, 2002
<i>Oecomys cleberi</i>	Gallery forest	Locks, 1981
<i>Oecomys concolor</i>	Gallery forest	Gastal, 1997; Palma, 2002
<i>Oligoryzomys microtis</i>	Gallery forest with influence of Amazonia (= vereda); wet campo	Lacher & Alho, 2001.
<i>Oligoryzomys stramineus</i>	Gallery forest	Talamoni, 1996; Gastal, 1997; Palma, 2002

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SPECIES	HABITATS	SOURCES
RODENTS – HABITAT SPECIALISTS		
<i>Oligoryzomys fornesi</i>	Gallery forest; cerrado (s.s.) and cerradoão.	Myers <i>et al.</i> , 1995.
<i>Oligoryzomys nigripes</i> (= <i>O. eliurus</i>)	Gallery forest; cerrado (s.s.) and cerradoão.	Myers & Carleton, 1981; Talamoni, 1996; Gastal, 1997; Lacher & Alho, 2001; Palma, 2002
<i>Oryzomys megacephalus</i> (= <i>O. capito</i>)	Gallery forest	Talamoni, 1996; Gastal, 1997; Palma, 2002
<i>Oxymycterus delator</i>	Gallery forest	Palma 2002
<i>Oxymycterus roberti</i>	Wet campo	Gastal, 1997; Lacher & Alho, 2001
<i>Pseudoryzomys simplex</i>	Campo-cerrado	Talamoni, 1996
<i>Proechimys longicaudatus</i>	Gallery forest (valley forest)	Gastal, 1997; Lacher & Alho, 2001; Palma, 2002
<i>Clyomys laticeps</i>	Cerrado (s.s.)	Palma, 2002
<i>Trichomys apereoides</i>	Cerrado (s.s. – rocks)	Lacher & Alho, 2001; Palma, 2002
<i>Cavia aperea</i>	Campo-cerrado; wet campo	Alho <i>et al.</i> , 1986; Talamoni, 1996; Gastal, 1997
<i>Rhipidomys mastacalis</i>	Gallery forest (valley forest); cerradoão.	Tribe, 1996; Gastal, 1997; Lacher & Alho, 2001; Palma, 2002
<i>Rhipidomys macrurus</i>	Gallery forest (valley forest); cerradoão.	Tribe, 1996.
<i>Euryzgomatomys spinosus</i> (= <i>E. guiara</i>)	Cerrado (s.s.); campo-cerrado	Woods, 1993; Lacher & Alho, 2001
<i>Thalpomys lasiotis</i>	Cerrado (s.s.)	Alho <i>et al.</i> , 1986
<i>Thalpomys cerradensis</i>	Cerrado (s.s.)	Palma, 2002
<i>Neacomys spinosus</i>	Gallery forest	Lacher & Alho, 2001
<i>Wiedomys pyrrhorhinos</i>	Cerrado (s.s.)	Reis, 1993
MARSUPIALS – HABITAT SPECIALISTS		
<i>Caluromys lanatus</i>	Mesophytic forest	Talamoni, 1996
<i>Caluromys philander</i>	Gallery forest	Lacher & Alho, 2001; Palma, 2002
<i>Gracilinanus agilis</i>	Cerradão; gallery forest (valley forest)	Gastal, 1997; Lacher & Alho, 2001; Palma, 2002
<i>Micoureus demerarae</i>	Gallery forest (valley forest)	Lacher & Alho, 2001; Palma, 2002
<i>Philander opossum</i>	Gallery forest	Alho <i>et al.</i> , 1986; Palma, 2002
<i>Marmosops noctivagus</i>	Gallery forest (valley forest)	Lacher & Alho, 2001
<i>Marmosa murina</i>	Gallery forest (wet forest)	Lacher & Alho, 2001
<i>Chironectes minimus</i>	Gallery forest	Alho <i>et al.</i> , 1986; Mares & Ernest, 1995
<i>Thylamys velutinus</i>	Cerrado (s.s.)	Vieira & Palma, 1996
<i>Thylamys karimii</i>	Cerrado (s.s.)	Reis, 1993

Generalist rodents (*Bolomys lasiurus* and *Oryzomys subflavus*), are caught in more than three different open habitats. Taxonomic studies have shown that this so-called *Oryzomys subflavus* is in reality a group of species: while *O. subflavus* is found in the ecotones of the Cerrado with the Atlantic Forest and the Caatinga, *O. scotti* is found in the Cerrado of central Brazil, where *O. maracajuensis* and *O. marinhui* also occur (LANGGUTH & BONVICINO 2002; BONVICINO, 2003). *Bolomys lasiurus* is one of the most common terrestrial small mammal species of the cerrado s.s. Its species density is around 11 individuals per hectare and home range sizes vary from 200 to 2,500m², most of the adult animals occupying an area of around 800m²; the areas occupied by adult males overlap with those of adult females more than with other groups of the same species, such as juveniles (ALHO & SOUZA, 1982). The average greatest displacement recorded for species, considering four or more recaptures, varies from 9m for *Akodon cursor* to 54m for *Gracilinanus agilis*, but the greatest movements of most species are between 20 and 40 m within their home range areas (GASTAL, 1997). Some recently described rodent species such as *Akodon lindberghi*, *Thalpomys cerradensis*, and *Microakodontomys transitorius* appear to be very restricted to their habitats and are rarely listed in field works. This may be due to the patchy nature of the Cerrado landscape, which probably led to the loss of the habitat of *Juscelinomys candango*, described by Moojen in 1965.

Among the species that occur in all forested habitats (Tab.1), habitat preference varies among different types of gallery forests, riverine forests (mata ciliar), mesophytic forest, and forested savanna (cerradão). Surveys in cerradão are scarce, and data on community composition for this habitat is, therefore, still incomplete. Small mammals occurring in open habitats, including arboreal savanna (cerrado) and all kinds of grasslands (campos) are either generalists (with a wide range of habitat use) or specialists (with habitat specificity).

Sex ratios of small mammals do not differ significantly from 1:1. Species show a rapid turnover in the study areas, with few animals persisting for one year (ALHO & SOUZA, 1982; MARES & ERNEST, 1995; GASTAL, 1997). Persistence of marked individuals in different study areas varies from 2 to 12 months from the first to the last capture. Mean persistence varies from 2 to 4 months. GASTAL (1997) reports a *Cavia aperea* recorded for 14 months in Brasília.

Reproductive activities and young individuals recorded in the surveys indicate, in general, reproduction throughout the year, but with peaks during the dry and/or wet seasons, depending on the species. *Bolomys lasiurus* has a peak in May-June. *Rhipidomys* displays three peaks: June-July (dry period), November-December (wet period), and August-September (dry period), whereas females of *Proechimys* are more sexually active in September-October (end of the dry season), according to GASTAL (1997). Small mammal biomass is greatest during the dry season (peaking in October, the end of dry period) both for forest dwellers and open habitat dwellers (GASTAL, 1997).

Detailed analysis using different methods has shown a high degree of habitat specificity for small mammals in open and forested habitats of the Cerrado landscape (NITIKMAN & MARES, 1987; LACHER & ALHO, 1989; LACHER *et al.*, 1989; HENRIQUES & ALHO, 1991; ALHO, 1993; MARES & ERNEST, 1995; TALAMONI, 1996; GASTAL, 1997; LACHER & ALHO, 2001; PALMA, 2002). Some studies have shown quantitative habitat variables which correlate with species richness and abundance of Cerrado small mammal species, including microhabitat components (ALHO, 1981; ALHO *et al.* 1986; LACHER *et al.* 1989; HENRIQUES & ALHO, 1991; LACHER & ALHO, 2001). A clear association between small mammal density and kind of habitats has been shown (GASTAL, 1997; TALAMONI, 1996; LACHER & ALHO, 2001; PALMA, 2002). Community compositions differ between two grassland habitats: drier habitat has fewer species, with 38% of the overall population density of the more mesic formation. *Oxymycterus roberti*, for example, prefers a narrow range of habitat within the Cerrado, being restricted to the moister portion of the grassland that has soft soil and abundant grass *Tristachia leostachya* (LACHER *et al.*, 1989).

Population parameters of gallery forest dwellers (*Didelphis albiventris*, *Gracilinanus agilis*, *Philander opossum*, *Akodon cursor*, *Nectomys squamipes*, *Oligoryzomys nigripes*, *Oecomys bicolor*, *Oryzomys capito*, *Rhipidomys mastacalis*, and *Proechimys roberti*), such as species richness, diversity, and biomass, are correlated with forest basal area, whereas the evenness of the total small mammal fauna is correlated with vegetation cover (GASTAL, 1997). In addition, species richness and diversity are correlated to gallery forest complexity, expressed by vertical habitat diversity.

When two sympatric rodent species are examined (*Bolomys lasiurus* and *Oxymycterus roberti*) for eight simultaneous microhabitat variables, patterns of habitat utilization and species relationships are distinct. The two species differ markedly in three microhabitat variables: plant species richness, forb ground cover, and distance to the nearest tree or shrub. While *Bolomys* is more a generalist, *Oxymycterus* is more a specialist associated with less diverse lower forbs, shrub, tree cover and higher ground cover (HENRIQUES & ALHO, 1991). Small mammals have the ability to explore the vertical strata of the habitat. Some genera are essentially arboreal, such as *Oecomys* and *Rhipidomys*. Experimental work carried out in a laboratory setting to test the scansorial and particularly the climbing ability of *Oligoryzomys nigripes* (formerly *O. eliurus*) and *Oryzomys subflavus* (*Oryzomys subflavus* species group) has demonstrated these species' ability to explore the arboreal stratum. They ascend trees using their tails as balancing aids: the animal keeps its tail stretched parallel to the branch when climbing. *Oligoryzomys nigripes* exhibits better arboreal performance than *Oryzomys subflavus* (ALHO & VILLELA, 1984).

The combination of vegetation type and substrate structured the community of 19 terrestrial species studied in the Cerrado of Mato Grosso into several smaller communities with little faunal overlap (LACHER & ALHO, 2001). This study showed that most species were captured in only one or two of the qualitative habitat types. There were open-habitat species that were completely absent from forest, and forest species that were captured only in forest habitats. Additional cluster analysis of those 19 species confirmed the separation made by qualitative classification of habitats based on plant species composition and other habitat characteristics. The results for habitat associations of small mammal species determined by cluster analysis of soil and vegetation structural characteristics (independently of plant species composition) generated five fairly distinct clusters. The gallery forest cluster grouped the same set of species that had previously been assigned to gallery forest (*Neacomys spinosus*, *Oryzomys megacephalus*, *Nectomys squamipes*, *Oecomys bicolor*, *Proechimys longicaudatus*, and *Caluromys philander*), confirming the earlier analysis. The cluster analysis also grouped the six species that had previously been associated with wet campo (*Oligoryzomys microtis* — occurring at the Cerrado-

Amazonia contact zone, *Oligoryzomys nigripes* (= *eliurus*), *Oryzomys subflavus* species group, *Bolomys lasiurus*, *Monodelphis domestica*, and *Marmosa murina*). The grouping of species was essentially the same whether it was done qualitatively by habitat type or by a quantitative analysis of structural aspects of the vegetation and substrate of the habitat (LACHER & ALHO, 2001). Small mammals of the Cerrado show a distinct population fluctuation as a function of marked seasonality (dry and wet seasons). *Bolomys lasiurus*, for example, shows a recruitment of young into populations when there is abundance of Cerrado grass seeds (at the end of the wet season and beginning of the dry season), and five species of gallery forest dwellers (*Oecomys bicolor*, *Oecomys concolor*, *Oligoryzomys nigripes*, *Rhipidomys mastacalis*, and *Gracilinanus agilis*) display peaks during the wet season and population decline during the dry season, although this pattern is not clear for all species (ALHO *et al.*, 1986; MARES & ERNEST, 1995). While *Oecomys bicolor* densities peak at the end of the dry season, *Oecomys concolor* presents greater density in the middle of the dry season (GASTAL, 1997). Both species are arboreal but *O. bicolor* uses the upper stratum (more than 80% of captures occur in trees) while *O. concolor* uses the stratum closer to the ground. In surveys comparing disturbed and undisturbed canopies in gallery forests, *Oecomys bicolor* proves to be sensitive to habitat modification by occurring at lower densities (PALMA, 2002). When the same analysis is carried out for disturbance of the forest understory, all species are affected.

Nectomys squamipes is only captured in the interior of the gallery forest, in habitat associated with water. Peaks of species abundance, biomass and richness occur at the beginning of the dry season, when *Bolomys lasiurus* in the open habitats and *Proechimys roberti* in the gallery forest are the dominant species (GASTAL, 1997). The species of *Oligoryzomys* are associated with the gallery forest but *O. microtis* is found at the forest edge in the Cerrado-Amazonia contact zone (LACHER & ALHO, 2001).

In large-scale analyses, such as comparisons among different river basins, small mammal communities differ in composition and abundance (LACHER & ALHO, 2001; PALMA, 2002). The latter author concluded that the small mammal communities of the Tocantins river basin are different from those of the Paraná/São Francisco river basins; the differences are more notable between basins rather than within basins. While the Paraná/São Francisco

communities are composed of essentially the same species, the Tocantins community has a greater number of species, particularly marsupials. Differences were also detected between small mammal communities of plateaus (above 900m) and lowland depressions (PALMA, 2002). In addition, the larger and the more pristine the forested habitats, the greater is the number of small mammal species in the community.

The small mammal community stays intact until a drastic habitat disturbance affects habitat integrity, for example inundation due to the formation of a reservoir for a hydroelectric plant (ALHO *et al.*, 2003). All these findings appear to be consistent with the mosaic aspect of different niches present within the Cerrado biome. It is still too early to pursue a unifying conclusion on the Cerrado small mammal community assemblage, although current knowledge has opened the door to discussions of community organization. Large-scale habitat disturbances, such as the use of fire and the conversion of natural vegetation into pasture or soybean plantations, have the potential to alter population parameters, community structure, use of space and other ecological requirements of the Cerrado small mammal assemblages. Patches of cerradão, for example, are rapidly disappearing as natural vegetation is converted into agricultural land or pastures for cattle ranching, since the soils in these areas are generally richer in nutrients. Such environmental alterations can damage habitat specialists and benefit pan-habitat species, changing community composition associated with pristine habitat gradients in the Cerrado landscape. *Bolomys lasiurus*, for example, has adopted peri-urban habits and is found in areas of human occupation inhabiting natural habitats recently converted into crop fields, and recently it has been incriminated in the spread of hantavirus. In the outskirts of Brasília in 2004, the Health Service of the Federal District confirmed 37 cases of the disease in humans with 16 deaths.

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